The Mechelectiv

VOLUME 27 NOVEMBER–1968 No. 2

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SCHOOL OF ENGINEERING AND APPLIED SCIENCE

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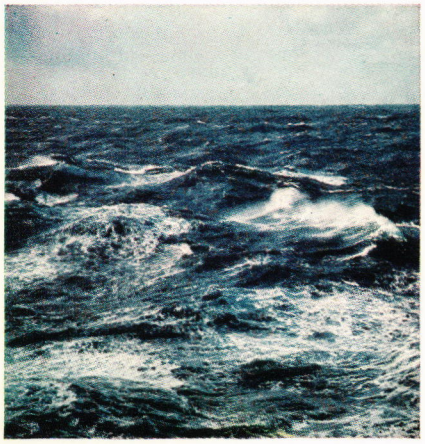


These graduates needed: Electrical Engineering, Chemical Engineering, Materials Science, Physical Sciences, Industrial Engineering, Engineering Mechanics, Mechanical Engineering, Civil Engineering.

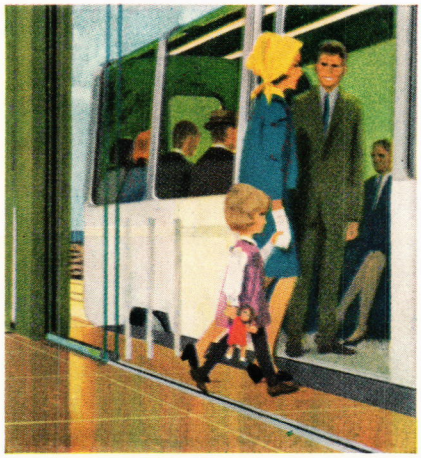
Telecast live from the moon

with the company that developed a shoebox-sized TV camera so sensitive it sees in the dark. In the years we've been working on space, we've also developed portable power plants, rendezvous radar, NERVA rocket propulsion. For projects of the future, we want minds whose only ceiling is infinity.

These graduates needed: Electrical Engineering, Aerospace Engineering, Mechanical Engineering, Physical Sciences, Mathematics.

Take walking out of flying

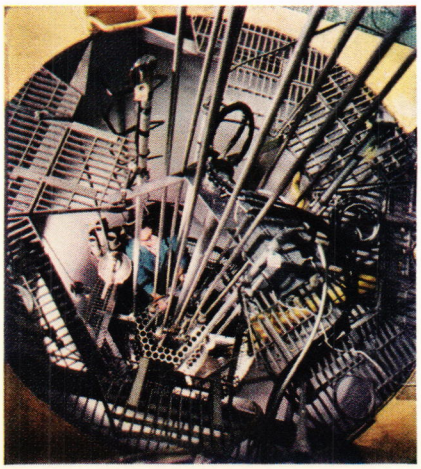
with the company that builds systems to transport people automatically from waiting area to aircraft. Westinghouse is providing new solutions to some of the toughest mass transportation problems of the jet age. What we need is more people to help us move more and more people.



These graduates needed: Transportation Engineering, Electrical Engineering, Mechanical Engineering, Industrial Engineering, Computer Sciences.

Create infinite energy

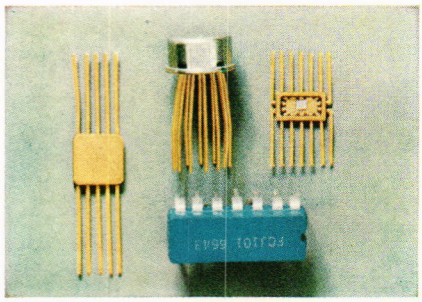
with the company that is building "fast-breeder" reactors. These sodium-cooled fast-breeder plants will produce more nuclear fuel than they consume by converting uranium into plutonium. Westinghouse built the first nuclear generation plant. The people we hire now will work on the most sophisticated nuclear power facilities in the world.



These graduates needed: Chemical Engineering, Mechanical Engineering, Control Engineering, Nuclear Engineering, Physical Sciences.

Think tiny

with the company that develops micro-miniature circuits so small that we can put everything that makes a TV set tick—except the picture tube itself—on the surface of a dime. The smaller the components, the more ingenious the people behind them must be. Talk about new challenges . . .



These graduates needed now: Electrical Engineering, Physical Sciences, Mechanical Engineering, Chemical Engineering, Industrial Engineering.

Teach people

who will teach the world with the company that has conducted more Peace Corps and Vista Volunteer training programs than any non-university source. If you want to help develop programs that will help to find out how people learn, Westinghouse wants to learn about you.

These graduates needed: Electrical Engineering, Systems Engineering, Computer Sciences, Social Sciences, Mathematics, Physical Sciences.

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Can there be this kind of excitement in engineering?

A long beautiful drive... just the hint of a slice... and *almost* on the green. Now, address the ball... concentrate—and, wham! to a lie four feet from the cup.

That's the excitement of the game that gets a golfer up at dawn on Saturdays.* We think it's analogous to the excitement that keeps some of our technical people on the job after hours: the pleasure of personal achievement in solving problems for which there are no book solutions.

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See your Placement Director or write to Mr. Roger Vander Ploeg, Xerox Corporation, P.O. Box 251, Webster, New York 14580.

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This console is part of a computerized system that speeds tests on new products and components.

* If you need more excitement, you might find it on the 42 golf courses in the Rochester area.

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FRONTISPIECE

The Davis-Hodgkins House

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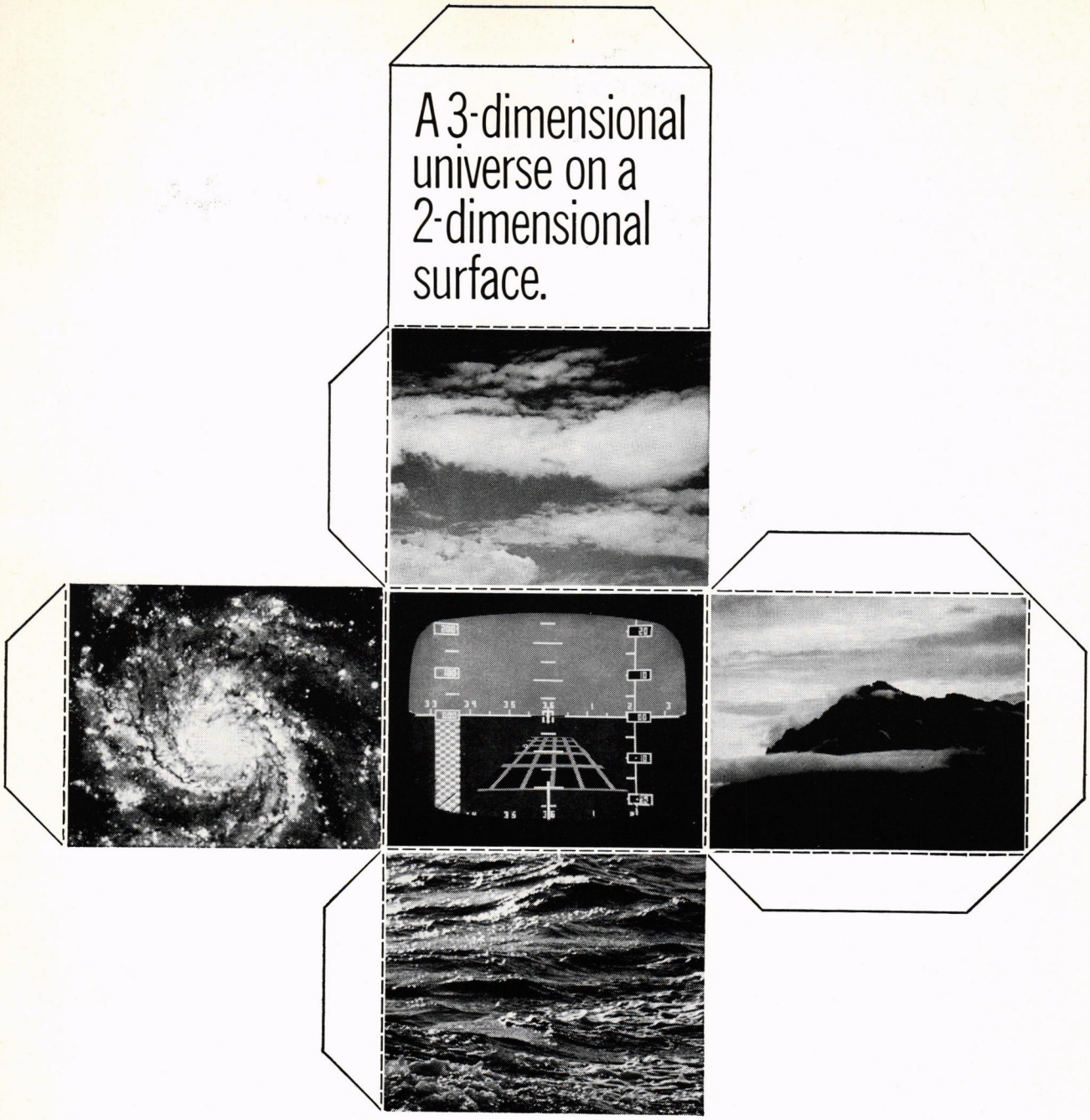

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You're looking at Contact Analog, Norden's innovative display system that packages the world in a mere ½ cubic foot. Height, width, depth and data projection capabilities are translated instantly into easily assimilated pictorial form. And the applications are virtually limitless—for air/space craft, land craft and underwater vessels.

It's a challenging concept. And only one of the numerous breakthroughs that Norden is pioneering. Our problem-solving teams are constantly exploring new ideas, tackling them from every aspect, and bringing new technological dimensions into being. It's this kind of teamwork that gives us the broadest capabilities possible—and gives our engineers the most diverse interchange of ideas and approaches—in the areas of pilot displays, airborne radar systems, ground support equipment, optical devices and computer technology.

If you're interested in new dimensions in engineering creativity—and career opportunity—then get with the Norden team. We've a great location in Fairfield County, Connecticut, just 41 miles from the heart of New York City...we offer a corporate-financed Graduate Education Program...and we have openings in Research, Development and Manufacturing. 1969 graduate EE's and ME's are invited to contact their Placement Directors to arrange an on-campus interview. Or forward resumes to: Mr. J. E. Fitzgerald, Helen Street, Norwalk, Connecticut 06852. An Equal Opportunity Employer (m/f).

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MECHELECIV

THE DAVIS-HODGKINS HOUSE was presented to the students of The George Washington University School of Engineering and Applied Sciences on February 14, 1954 by the President of the University at that time, Cloyd Heck Marvin. The house was dedicated in the names of Arthur Powell Davis, Director of the U.S. Reclamation Service and Howard Lincoln Hodgkins, dean of the University.

The D-H house is presently furnished with the chairs, tables, and lounges discarded from the old student union. The intentions of the University in giving this furniture to the Engineers was undoubtedly good at the time, but only the derelicts and remnants of the original furnishings remain, and these are no longer sufficient. In the past this furniture was accepted by the students as a necessary part of the nearly deserted building known as the D-H house, but the building is finally coming into its own as a place to spend one's time between classes in discussion with other students, or as a quiet place to study or to just be alone. The situation involving the use of the D-H house has changed, and at last the condition of the house is being improved to encourage this change.

The Engineer's Council and other engineering school organizations have been successful in persuading the University to render the D-H house in livable condition. Upon the request of the Engineer's Council, and specifically through the efforts of S. Joel Marenberg, the D-H house has received a coat of paint, new lighting fixtures, and new locks. Other improvements are forthcoming according to the Business Office of the University. These improvements include new furniture, window shades, and eventually air-conditioning. Once these improvements have been completed the house will be much more comfortable than it is now, and hopefully its appeal will improve accordingly.

The original intent behind the D-H house was to bring prospective engineers together, and now through the combined efforts of the Engineering School and the University this objective will be fulfilled.

LETTER TO THE EDITOR

Often students in this school are led too far from their objective – to become recognized as capable and proficient engineers. Elective topics, required subjects, and engineering courses in fields other than one's particular major assume a disproportionate amount of influence in the freshman, sophomore, and junior years. They divert attention from the principle interest and contribute to a lack of preparedness encountered in vitally important subjects in the senior year.

The SEAS could help alleviate the burden of time-consuming elective courses by instituting a pass-fail system. Underclassmen may not, at this time, recognize the great potential harm in their present situation as clearly as upperclassmen can see the desperate need for a policy change. Of course, the individual's quest for knowledge should not be hampered or restricted, but neither should a student, who can afford little distraction from his demanding course schedule be refused the opportunity to realize and establish for himself the relative values among his courses.

The pass-fail system will permit balancing and adjustment for those who elect to use it. In the present system, the grade-oriented student realizes that, in general, an hour's study in a non-engineering course can help produce a higher grade than the same time spent on an engineering subject. Later, this price is paid heavily, for those same students will find that they have spent many long hours engulfed in what now has become an inconsequential topic. The aim of this system then is to encourage the students to begin their specialization earlier, and with this improved aid and emphasis to develop a more highly capable Bachelor of Science.

Having suggested the adoption of this system to cure an ill, I wish it to cover as many elective subjects as the school could permit. The new opportunity should also be made available to all undergraduate students regardless of their academic standing, to ensure all the greatest benefit for their education.

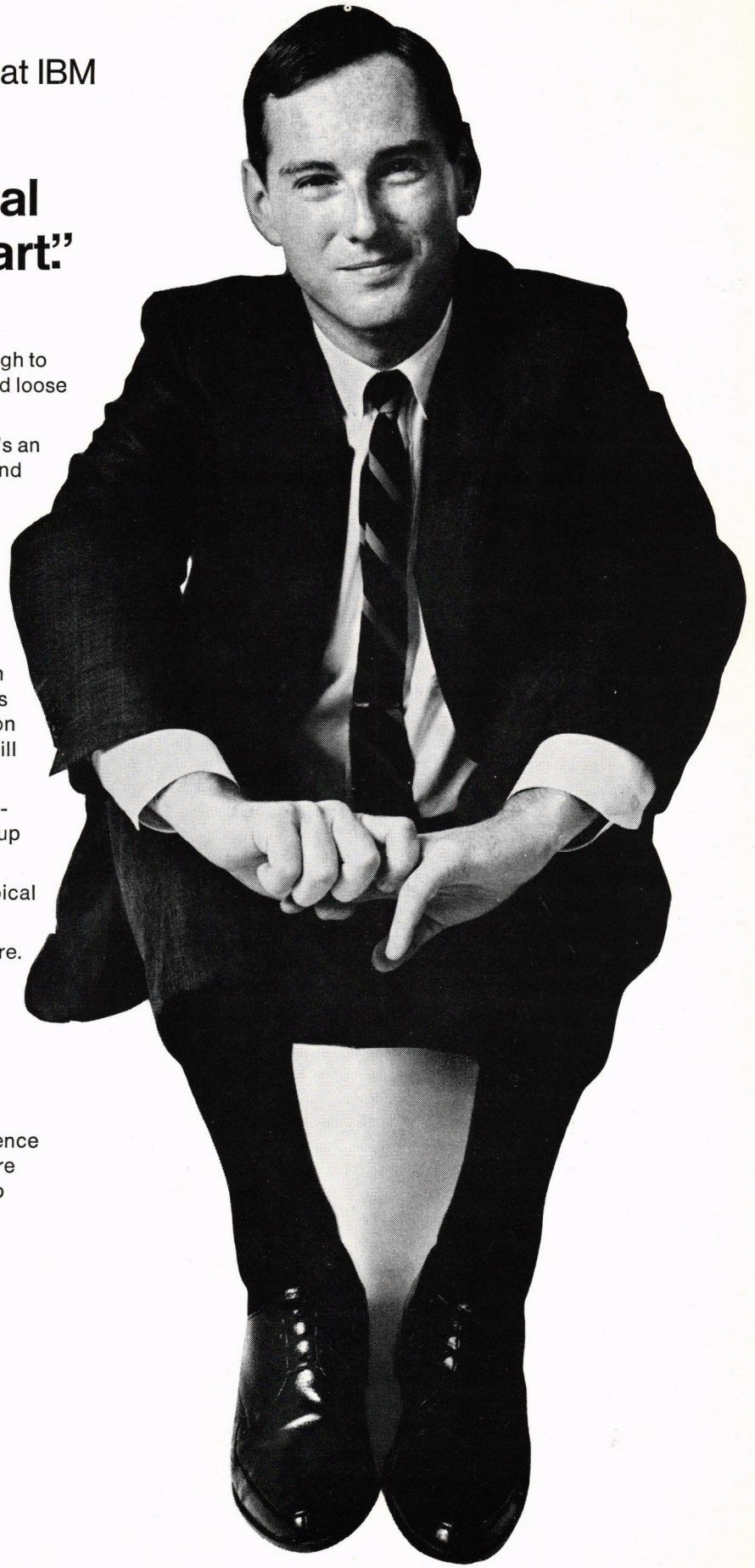
For these reasons, I ask the faculty and the departmental chairmen for their consideration, support, and action in this area of academic improvement; and further, that serious thought be devoted to an extension of the program to one of a similar nature and purpose for required courses apart from one's major, to develop the truly flexible system necessary to rid us of these costly mis-directed energies. With implementation, the faculty could foster a program to train a more highly motivated, capable, and proficient engineer.

The success of the program will depend upon both the students and the faculty in its realization. While the program may not benefit presently enrolled students, your student action and words of encouragement will help our school and all of its future graduates to realize a more satisfying and beneficial education.

George C. Stellar

Engineering and Science at IBM

"You're treated like a professional right from the start."



"The attitude here is, if you're good enough to be hired, you're good enough to be turned loose on a project," says Don Feistamel.

Don earned a B.S.E.E. in 1965. Today, he's an Associate Engineer in systems design and evaluation at IBM.

Most of his work consists of determining modifications needed to make complex data processing systems fit the specialized requirements of IBM customers.

Small teams

Depending on the size of the project, Don works individually or in a small team. He's now working with three other engineers on part of an air traffic control system that will process radar information by computer.

Says Don: "There are only general guidelines. The assignment is simply to come up with the optimum system."

This informal working environment is typical of engineering and science at IBM

Don sees a lot of possibilities for the future. He says, "My job requires that I keep up to date with all the latest IBM equipment and systems programs. With that broad an outlook, I can move into almost any technical area at IBM."

Check with your placement office

If you're interested in engineering or science at IBM, ask your placement office for more information. Or send a letter or resume to Mr. Paul Koslow, IBM Corporation, Department BL2002, 425 Park Avenue, New York, New York 10022.

We'd like to hear from you even if you're headed for graduate school or military service.

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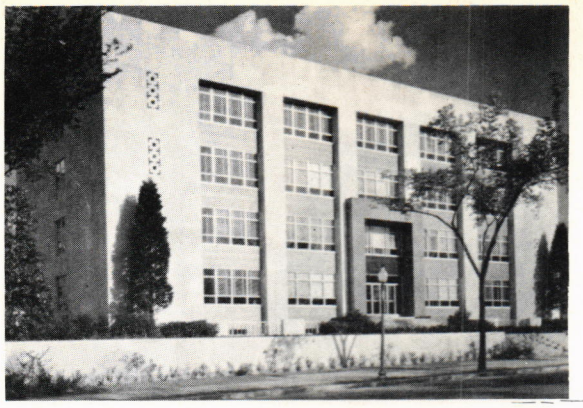


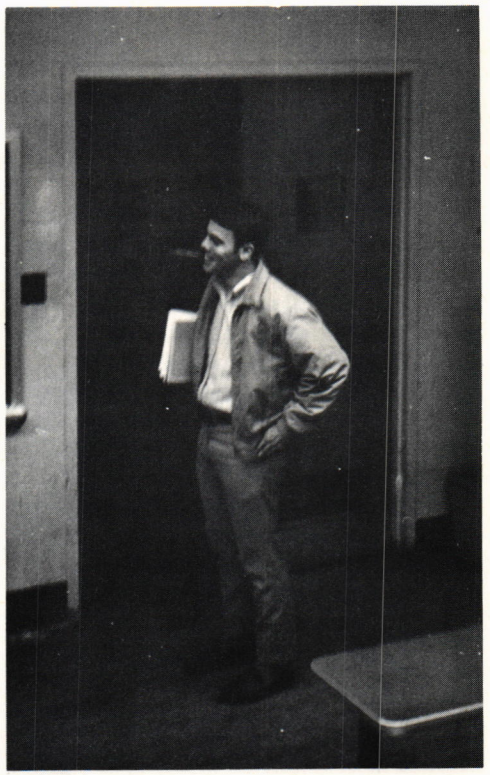
Campus News

ENGINEER'S COUNCIL

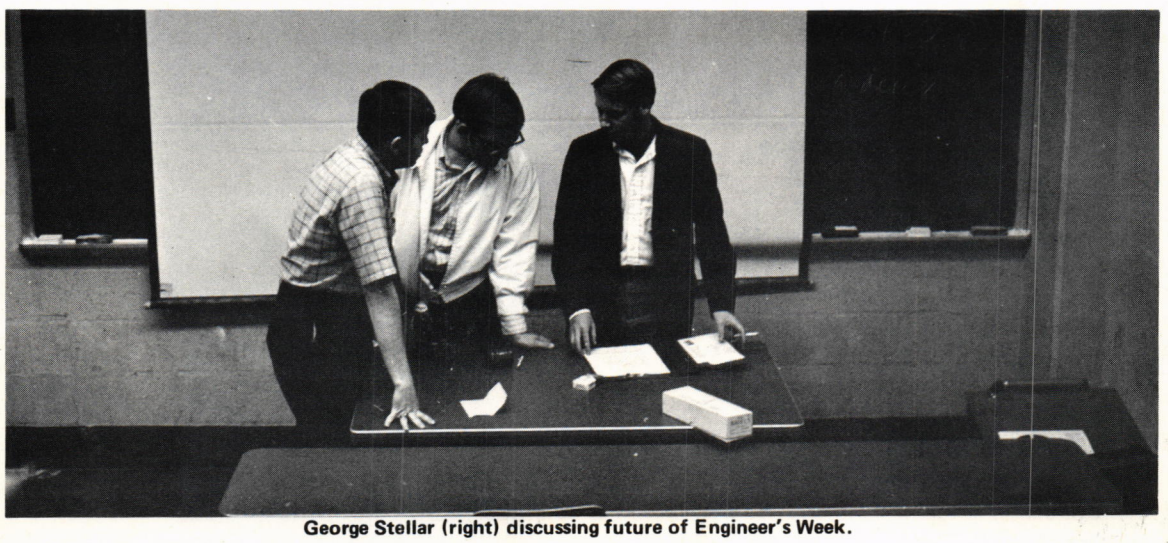
On October 6, The Engineer's Council of The School of Engineering and Applied Science held its first meeting of the school year. President George Stellar announced these resignations: James B. Bladen resigned his post as secretary in order to devote his full time as Editor of The **Mecheleciv**, and John Liesbesny resigned his post as Engineer's Week Chairman, thus creating a new vacancy on the council. There were two new council members, James Wong representing the graduate school and Ken Dampier representing ASCE. Christopher A. Kouts was then elected as the new secretary.

President Stellar stated the wish of the Dean to have a continuous Student-Faculty Mixer every day. The Mixer will consist of a room with a coffee maker to provide an opportunity for continuous relations outside the classroom between the professor and the Student.

SEAS Representative, Joel Marenburg, requested the help of all Engineers to build the Homecoming Pavillion for the Student Council.



Cris Kouts



George Stellar (right) discussing future of Engineer's Week.

CONTINUED ON PAGE 29

When you start knocking on doors try ours first.

Looking for excitement, challenge, and opportunity for creativity? Look into Raytheon where electronic frontiers are being explored from inner to outer space . . . in underwater acoustics, radar, space, communications, and missile systems . . . where a healthy mix of commercial and government business provides stability.

Looking for growth opportunities? Raytheon's sales doubled in the last two-year period. 1970 corporate growth goals were achieved by early 1968. Revised goals for 1970 are based on continued growth.

Opportunities abound at all degree levels for:

Electrical Engineers	Business Administration
Mechanical Engineers	Finance
Industrial Engineers	Accounting
Aeronautical Engineers	Industrial Relations
Mathematics	Purchasing
Physics	Industrial Administration

After years preparing for the "right" job . . . take time to select the "right" company. For a copy of Raytheon's latest brochure, or to arrange an on-campus interview, contact your placement director or write: Manager of College Relations, Raytheon Company, Lexington, Mass. 02173.

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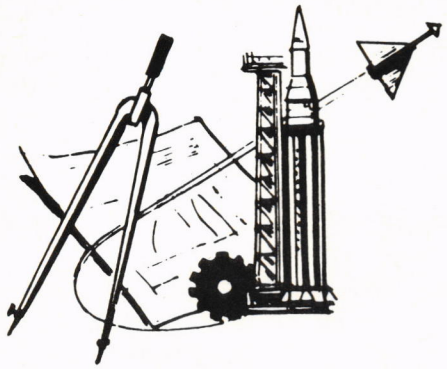


Tech News

Edited by David R. Armstrong, E.E., 70

FLEXIBLE-BASE TRANSISTORS

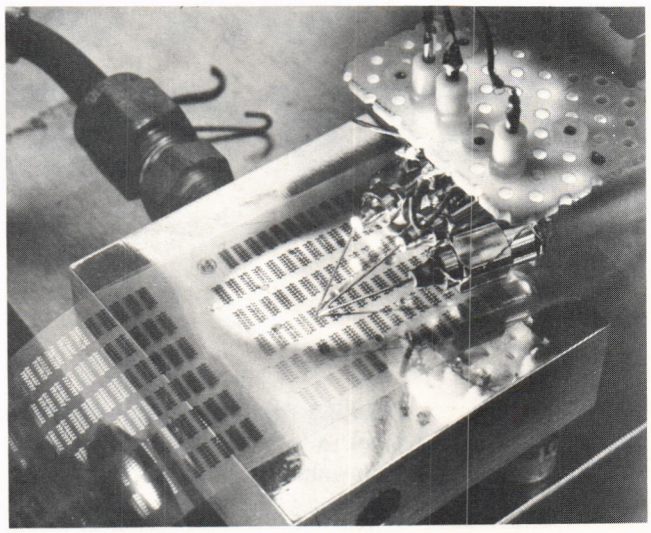
Transistors are now being fabricated on a wide variety of flexible bases by scientists at the Westinghouse Research Laboratories. Some of the bases or substrates used include mylar tapes, cellulose acetate film, polyimides, anodized metal foils, and even rough-textured paper.

These thin-film flexible transistors have stable operating characteristics and some have worked at frequencies up to 60 MHz. The use of flexible and comparatively rough-surfaced substrates offers several potential advantages ovyr the conventional materials.

First, the use of inexpensive bases for thin-film transistors may eventually reduce the cost of transistors substantially for many applications where cost is now prohibitive.

Second, use of flexible substrates offers the significant possibility of mass production of thin-film transistors in continuous rolls or strips. At present, Westinghouse scientists can deposit over 600 of the new devices per frame on an area of about one square inch. Also, since thin-film passive components, such as capacitors, resistors, and interconnections are readily prepared by the same techniques, this development may permit the fabrication of circuit arrays on a continuous substrate tape, which can then be tested and encapsulated.

Although the "flexible tape" transistor looks most promising, the development is still in its early stages and a commercial product cannot be expected for several years.



658 Tellurium Transistors (94 groups of 7) are Printed Simultaneously on Mylar Substrate.

EAI ANNOUNCES NEW 100-V ANALOG/HYBRID COMPUTING SYSTEM

Electronic Associates, Inc., manufacturer of scientific computing systems, announced the EAI 7800, a new 100-V machine designed to augment its family of analog/hybrid computers.

According to Mr. Robert Yeager, marketing director of EAI, the computer offers a new degree of performance, flexibility and versatility combined with low initial cost and economical throughput. Mr. Yeager noted that the EAI 7800 contained the latest EAI design features, and that the over-all design had been developed in direct response to an exhaustive research of user requirements. Users may select an analog/hybrid configuration from 30 to 294 amplifiers . . . as well as a wide range of control and programming features. The basic console, wired for a minimum analog/hybrid configuration, can be expanded by adding functional modules . . . easily installed in the field or in the factory.

The EAI 7800 is designed to go hybrid or to be used in any number of one-line or real-time applications. Essentially, its simplicity of operation, its conventional patching and a broad range of peripheral equipment for data reduction, readout and recording make it a machine with a high degree of open-shop orientation.

A TV-like Picture of the First Chemical to be "Produced" Inside a Computer. The Photo Shows the Orbits After the Molecule is Formed.

SCIENTIST DISCOVERS NEW GAS IN FIRST COMPUTER SIMULATION OF CHEMICAL REACTION

The gas form of a compound thought to exist only as a solid has been discovered in the first computer simulation of a chemical reacton. The compound is called sal ammoniac. It is used in cough medicines and as an electrolyte in batteries.

Instead of preparing the chemical in a conventional test-tube reaction, Dr. Enrico Clementi of IBM's Research Laboratory in San Jose, Calif. described its atoms mathematically and "mixed" them in a System/360 Model 65.

The computer simulation showed that sal ammoniac could exist as a gas and pinpointed the temperature and pressure required to produce it. Later, independent researchers used this information to produce the gas form of sal ammoniac in a conventional laboratory experiment.

Dr. Clementi stated that scientists now may be able to learn more from a computer simulation of a chemical reaction than from a real experiment.

Calculations with up to 50 different atoms have been performed in the computer, said Dr. Clementi. Because each atom is described completely – right down to the electrons spinning around the nucleus – the simulation produces results just as valid as an actual experiment. The computer experiments can provide scientists with information about reactions which are too subtle or fleeting to measure with conventional laboratory instruments. In addition, they can tell scientists if a new molecule exists and how to go about duplicating it in a conventional laboratory experiment.

The computer also has been connected to a television-like screen to show step-by-step images of the simulated atoms as they combine to form complex molecules.

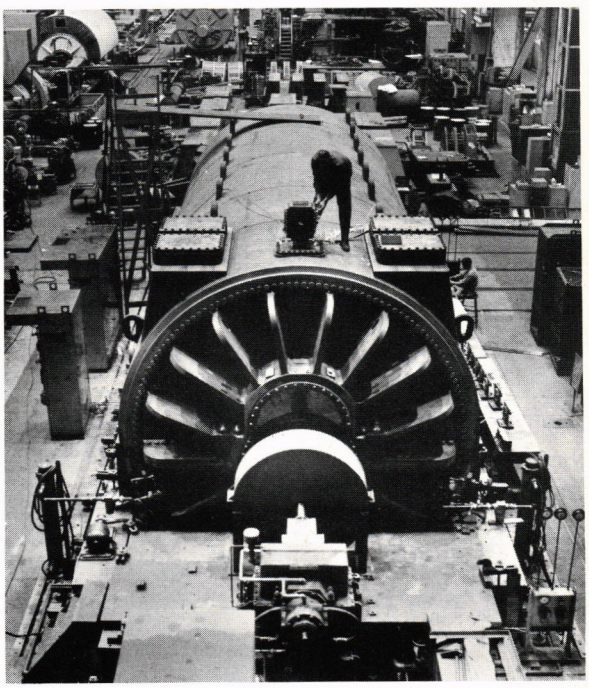
Dr. Clementi said that chemists, until now, have been handicapped because they could not see what was happening to the chemicals in the test tube. The computer gives the chemist a look into the sub-miscroscopic world and what goes on there.

WORLD'S MOST POWERFUL ELECTRIC GENERATOR

The most powerful electric generator ever built was shipped this past summer by the Westinghouse Electric Corporation for installation at the Indian Point II nuclear power plant of Consolidated Edison Company at Buchanan, N.Y.

Shown while undergoing tests on the manufacturing floor of the huge Westinghouse plant here, the generator is rated at a record 1,013,040 kilowatts – enough to meet the residential electric needs of three million people when it goes into operation next year. The generator's rotor alone is 67 inches in diameter and weighs 365,000 pounds, yet it will spin at 1,800 revolutions per minute to produce electricity. The entire generator is 47 feet long and weighs 1,560,000 pounds.

Because of its immense weight, the generator had to be shipped disassembled by railroad to Jersey City, N.J. The world's largest railroad car, owned by Westinghouse, carried the machine's inner frame, while six other rail cars carried other components. At Jersey City, the components were loaded onto barges for the trip up the Hudson River to an unloading point about a mile from the Indian Point plant site. Special trucks then carried the components to the site.



A Technician Tests the World's Most Powerful Electric Generator.

CONTINUED ON NEXT PAGE

Burrough's New 3350 Electronic Desk Calculator Automatically Extracts Square Roots in One-Third of a Second.

NEW ELECTRONIC DESK CALCULATOR INCORPORATES INTEGRATED CIRCUITS

Burroughs has announced a new generation of electronic desk calculators which provide silent, instantaneous computing power in a compact, light-weight unit. Called the Series C3000, the new calculators utilize the latest integrated circuits as modern as those used in third generation computers.

President Ray W. Macdonald said that these integrated circuits increase reliability, while at the same time, the size of the circuits is reduced. These new circuits enabled Burroughs to significantly reduce the size and weight of the new calculators.

With the C3000, Burroughs offers compact calculators which are easy to operate and use a small amount of desk space. Yet, they are so powerful they provide the answers to algebraic or arithmetic problems with electronic speed and in complete silence. In addition, they are simple to operate because the customer solves his problem just as he would say it.

The top-of-the-line C3350 Electronic Calculator, which can automatically extract a square root in less than one-third of a second, features two independent core storage memories. Each memory provides 16 digit, eight decimal storage capacity with minus total.

In addition, a constant factor memory retains a multiplier or divisor completely separate from the storage memories. The constant factor used during the calculation does not require any key depression after the initial step and it can be reviewed or changed at any time during the operation.

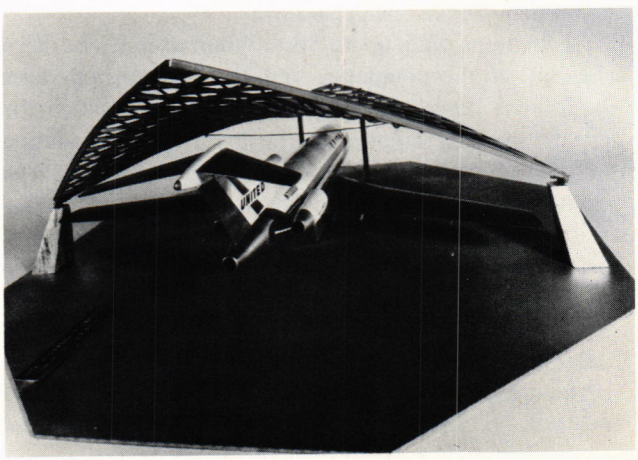
Operational mode lights indicate that the calculator is in multiply or divide mode and also continually tell the operator what step has been completed and what should be done next. Independent memory lights also indicate whether memories contain stored amounts.

Independent decimal selection for computing and memory provides increased accuracy by allowing the operator to use a large number of decimals in computations while selecting only the number of decimals considered significant for memory storage.

Selective round-off of products and quotients occurs in the appropriate column according to the setting of the Memory Decimal Selector. In chain calculation, round-off occurs only on operator command. A versatile recall key allows the operator to re-display any factor in the calculation with decimal points properly placed whenever desired.

HYPERBOLIC PARABOLOID TO SHELTER UNITED JETS FOR OVERNIGHT MAINTENANCE

Largest steel hyperbolic paraboloid, currently under construction at Wold-Chamberlain Field, Minneapolis, will provide "minimum envelope" for overnight maintenance of United Air Lines Boeing 727 and DC-8 jet aircraft as illustrated in the photo. The hangar conforms to the shape of the plane, yet encloses only one-third the space of a conventional one-plane hangar, cutting construction and maintenance costs. Design concept was developed by Charles R. Hutton, Professor of Construction Technology at the Calmet campus of Purdue University, with construction research sponsored by the Inland Steel Company.



Hyperbolic Paraboloid Shelters United Jets.

We developed TV transmission. But a lot of engineers still don't get the picture.

Like, we'll ask a graduating engineer: "What opportunities do you think an engineer has if he works for the telephone company?"

And, zap—we get a blackout!

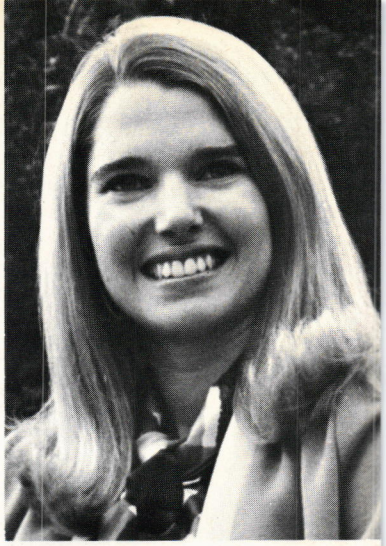
Well, we think the company responsible for engineering innovations such as the transistor, radio astronomy, high fidelity and stereo recording, magnetic tape, synthetic crystals, negative feedback, sound motion pictures, microwave relay, electronic switching, the solar battery and telstar deserves a consideration that's strong and clear.

When the Bell System recruiting team comes to your campus, be sure to talk to them. Or ask your Placement Director for the name of the Bell System recruiter at the local Bell Telephone Company.

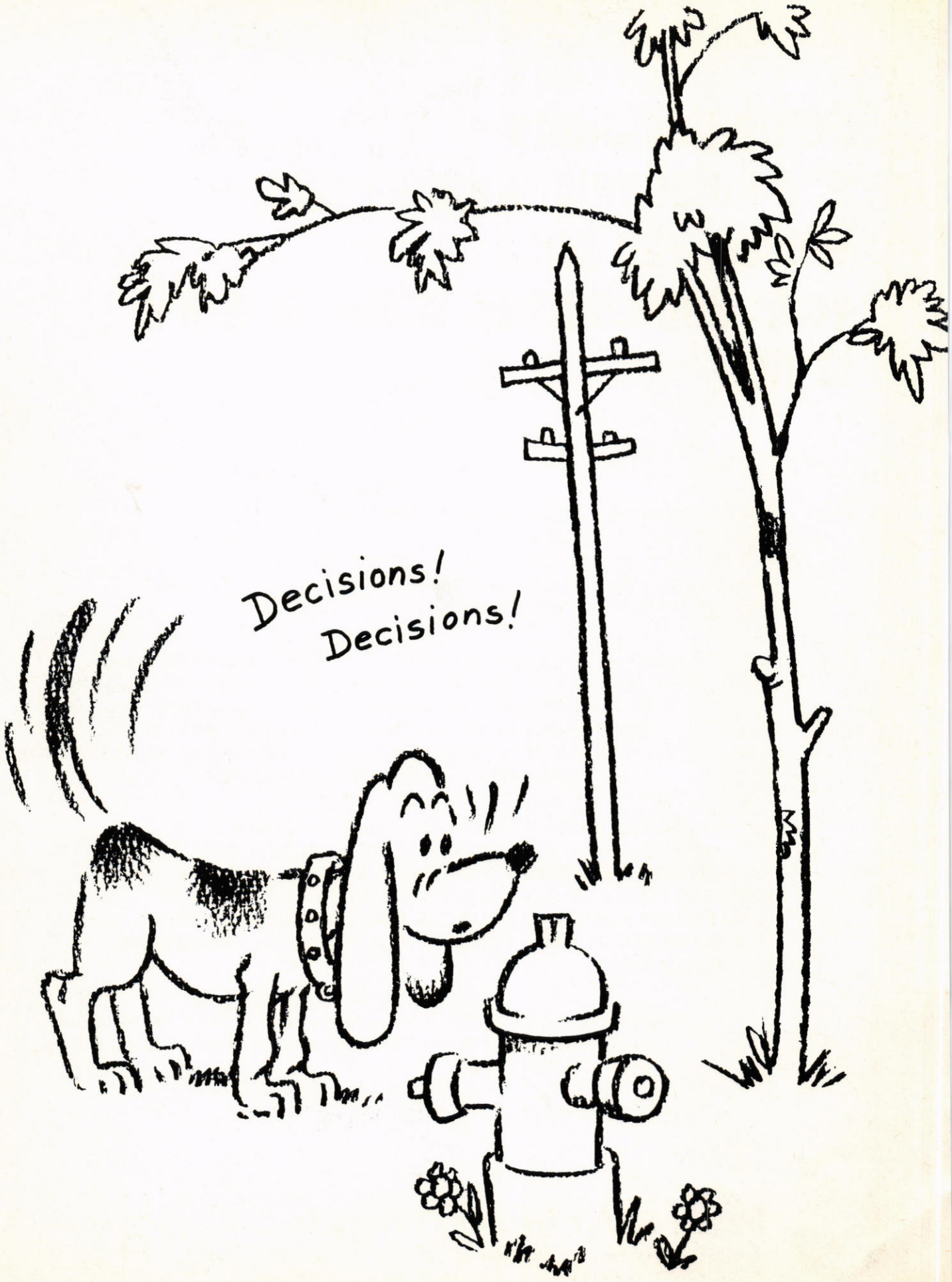
We'll turn you on.

AT&T
and Associated Companies

Mech Miss



This month's Mech Miss is Barbara Kesselman, a senior from Verona, New Jersey. She is majoring in French Literature and Romance Languages. She is interested in all sports from tennis to skiing, and loves all kinds of music. After graduation Barbara hopes to do graduate work in one of the universities in New York.


Decisions!
Decisions!

Some decisions are relatively unimportant. Where you put your engineering talent to work is not.

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A COMPUTER SCIENCE CURRICULUM

By A. C. Meltzer

Rumors are spreading that the School of Engineering and Applied Science (SEAS) is going to offer a Computer Science undergraduate major. What is a Computer Science major? What is Computer Science?

Here's the story. Yes, it's true, SEAS is going to offer a Computer Science undergraduate major. The initial effort will be undertaken as an option within the Department of Electrical Engineering for the academic year 1969-70. It is anticipated that the initial course offerings will be expanded in subsequent years until a full undergraduate Computer Science curriculum has developed. The rate of expansion is dependent upon the success of the course offerings.

Although no undergraduate Computer Science option is currently offered, a large graduate program is in existence in the SEAS. The graduate program offers such courses as Finite State Machines, Finite Automata, Design of Compilers, Digital Computer Systems, Analog and Hybrid Computers and others. This program has been very successful and has prompted the initiation of the undergraduate curriculum. But what is computer science?

At the present time this question cannot be precisely answered. The field of "computer science" is so new that even its name is not secure. Some advocate calling this field "information science" and a debate exists as to what the field includes and excludes. The discipline has grown from certain well-defined classical areas. Among these are electrical engineering, applied mathematics, linguistics, and statistics. However, as in many new disciplines, computer science has grown so that now it is greater than the sum of the contributors from the other fields. The discipline has been indirectly defined by the Association for Computing Machinery (ACM) by its Curriculum Committee on Computer Science (C^3S). However, this definition which will be discussed in this article is not the final word. In fact, the final word will probably never be said. In addition to the ACM, the Commission on Engineering Education has a committee which has set forth guidelines in the establishment of computer curricula. It is called the COSINE Committee (Computer Science In Electrical Engineering).

Before describing the ACM undergraduate Computer Science curriculum in detail and the proposed initial SEAS program, the following excerpt from the 1968 C^3S report should be kept in mind.

"Computer science programs, in common with those of all disciplines, must attempt to provide a basis of knowledge and a mode of thinking which permits continuing growth on the part of their graduates. Thus, in addition to exposing the student to a depth of knowledge in computer science sufficient to lay the basis for professional competence, such programs must also provide the student with the intellectual maturity which will allow him to stay abreast of his own discipline and to interact with other disciplines."

The ACM has grouped the subjects of computer science into three major divisions. One division is Information Structures and Processes. This division is concerned with representations and transformations of information structures and with theoretical models for such representations and transformations. Some of the subject areas within this division are data structures; numbers; searching; sorting; programming languages; algorithms; linguistics; algebraic automata theory; models of computation; and classifications of languages.

A second division is Information Processing Systems which is the ability to transform information. These

systems (computers) usually involve the interaction of hardware (electronics) and software (programs). Some of the subject areas within this division are computer design and organization; memory structure; design of arithmetic units; input-output techniques; translators and interpreters; assemblers; compilers; computer operating systems; analog and hybrid computers; and multiprogrammed and multiprocessing systems.

The third division is entitled Methodologies which are derived from broad areas of application of computing which have common structures, processes and techniques. Some of the subject areas in this division are numerical mathematics; library systems, bio-medical and management information systems; text processing; computer graphics; artificial intelligence; process control; and computer aided instruction.

In addition to the above specific areas of computer science, there are many related areas of mathematics, statistics, electrical engineering, philosophy, linguistics and management which are needed to balance out a computer science program.

How are these subjects incorporated into courses and then into a computer science curriculum in SEAS? What effect will this have on existing programs? Will I lose credits?

The answer to the above is the following curriculum which was designed so as to minimize the disturbance within SEAS and to permit students within the EE department to elect the Computer Science option in their senior year.

The following chart lists the course numbers of the new Computer Science Option according to the new system for course numbering which will be initiated for the academic year 1969-70. The new numbers are shown followed by the old numbers in parenthesis.

1969-70 COMPUTER SCIENCE OPTION

First Semester

- Chem 11: General Chemistry (4)
- EE 51: (Engr 21) Applications of Computers (3)
- Math 21: Calculus I (3)
- Elective: Humanities or social science (3 to 6)

Second Semester

- Chem 12: General Chemistry (4)
- Math 22: Calculus II (3)
- Physics 30: Introductory Modern Physics (4)
- Elective: Humanities or social science (3 to 6)

Third Semester

- Math 23: Calculus III (3)
- Math 24: Calculus IV (3)
- Physics 31: Introduction to Theoretical Physics (2)
- Physics 51: Introduction to Experimental Physics (2)
- Elective: Humanities or social science (3 to 6)

Fourth Semester

- ApS 59: Introductory Analytical Mechanics I (4)
- ApS 113: Engineering Analysis I (3)
- Physics 32: Introduction to Theoretical Physics (2)
- Physics 52: Introduction to Experimental Physics (2)
- Elective: Humanities or social science (6)

Fifth Semester

- EE 31: (ApS 9) Fields & Waves I (3)
- EE 11: (ApS 29) Linear Networks I (3)
- ApS 60: Introductory Analytical Mechanics II (3)
- ME 131: (ApS 85) Thermodynamics (3)
- ApS 114: Engineering Analysis II (3)

Sixth Semester

- EE 32: (ApS 10) Fields & Waves II (3)
- EE 12: (ApS 30) Linear Networks II (3)
- EE 20: (Engr 18) Introductory Engineering Electronics I (3)
- EE 62: (Engr 100) Introductory Electrical Engineering Laboratory (3)
- CE 140: (ApS 101) Material Science (3)
- EE 152: (new) Introduction to Digital Computers (3)

Seventh Semester

- EE 113: (ApS 31) Network Analysis and Design (3)
- EE 121: (Engr 19) Engineering Electronics and Design (3)
- EE 163: (Engr 105) Electrical Engineering Laboratory I (3)
- EE 153: (Engr 121) Design of Switching Systems (3)
- EE 157: (Engr 171) Machine & Assembly Language Programming (3)
- Elective: Humanities or social sciences (3)

Eighth Semester

- EE 142: (ApS 50) Information Transmission, Modulation, and Noise (3)
- EE 172: (ApS 55) Control Systems (3)
- EE 122: (Engr 20) Pulse and Waveshaking Electronic Design (3)
- 154: (Engr 122) Digital Computers Design (3)
- EE 158: (Engr 172) Algorithmic Methods and High-Level Languages (3)
- EE 164: (Engr 106) Electrical Engineering Laboratory II (3)

CONTINUED FROM PREVIOUS PAGE

Description of Courses

EE 51 (Formerly Engr 21) Application of Computers (3)

Solution of problems on digital computers, using machine language and FORTRAN, data processing and numerical methods. Writing, debugging and running programs on a digital computer.

EE 152 (A new course) Introduction to Digital Computers (3)

Introduction to the use and structure of digital computers, addressing methods, data processing, and machine language programming; Boolean algebra and introduction to the design of combinational switching circuits; number systems and arithmetic in digital machines; machine subsystems and their interconnections; use of software systems and software-hardware relationships. Prerequisite: Electrical Engineering 51 or permission of instructor.

EE 153 (Formerly Engr 121) Design of Switching Systems (3)

Switching algebra and Boolean logic; analysis and design of switching devices; design of combinational and sequential logic networks; minimization techniques and their use in logic design; electronic implementation of logic; number systems and codes; geometric interpretation; error-correcting codes; encoding and decoding; logic and electronic design of functional digital units. Prerequisite: Electrical Engineering 152 or permission of instructor. May be taken for graduate credit.

EE 154 (Formerly Engr 122) Digital Computer Design (3)

Logical and electronic design of functional digital units, design of computer subsystems, flow of information and logical flow diagrams in timing and control; design of memory, arithmetic, and I/0 units; binary and decimal machine arithmetic, design of a digital computer. Prerequisite or concurrent registration: Electrical Engineering 153 or permission of instructor. May be taken for graduate credit.

EE 157 (Formerly Engr 171) Machine and Assembly Language Programming (3)

Machine and assembly language programming in fixed and variable word-length computers; techniques in addressing and machine control; data structures and data processing; use of subroutine linkages; co-routines, push-down lists, list processing, loops and input-output subroutines; use of a macro-assembly language; sorting, merging, arrays and data fields in data processing. Prerequisite: Electrical Engineering 152 or equivalent, or permission of instructor. May be taken for graduate credit.

EE 158 (Formerly Engr 172) Algorithmic Methods and High-level Languages (3)

Introduction to high-level procedural and problem-oriented computer languages; data structures and choice of a data processing language; list processing, string processing and introduction to information retrieval; large data bases and their use in time-shared systems; simulation languages; introduction to heuristic programming. Prerequisite: Electrical Engineering 51 or equivalent and permission of instructor. May be taken for graduate credit.

How does the curriculum compare with the courses and curriculum proposed by the ACM Committee? The ACM Committee did not propose a specific curriculum but it did give detailed descriptions of introductory (freshman-sophomore), intermediate (junior-senior) and advanced (senior-graduate) courses which it felt should be included in computer science curricula. The committee suggested that 10 of these courses should be included in any undergraduate curricula. The SEAS curricula has 6 of these courses; but remember that is just the start. Hopefully, with success, the curriculum will be expanded in the coming years to include all topics proposed by the ACM in new courses in SEAS.

We have attempted to show what is contained in a Computer Science Curriculum. We should also state what is not contained in such a curriculum. First computer science courses do not deal with application programming. This field is left to each of the other departments within a University. That is, the Department of Business Administration must teach how to use computers in business administration. Likewise, the Department of Statistics must teach how to use computers in statistical analysis, and so forth for each of the other fields in a University. Any attempt to introduce applications programming into computer science courses would swell the courses to a gigantic number; beyond the capabilities of any single department. Computer science courses deal with the theory and design, both hardware and software, of computers and computer systems. It teaches just enough applications program so that students of computer science can design better and more useful systems.

Computer Science does not teach students how to operate a particular computer. This field is left to the technical schools.

What is taught in computer science curricula? Com-

CONTINUED ON PAGE 31

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CONCRETE IN CONSTRUCTION

By Dennis G. Gallino

CONCRETE is a composite material which consists essentially of a binding medium within which are embedded particles of a relatively inert mineral filler. The filler material, called aggregate, is generally graded in size from fine sand to fragments of stone. The sand is called fine aggregate, and the fragments of stone are called coarse aggregate. Coarse aggregate can be slag, crushed stone, or gravel. Generally, particles smaller than 3/16 inch in diameter are designated as fine aggregate sand. The aggregate occupies roughly three-quarters of the space within a given mass; the other one-quarter is filled with cement, water and air voids.

The solid portion of hardened concrete is composed of the mineral aggregate, some of the original cement, and a new paste-like product formed by a combination of the remainder of the cement with some of the water. After any period of time, the amount of free water left depends upon the extent of combination of cement and water, and upon possible loss of water from the mass due to evaporation.

The functions of the paste are to fill the voids between the particles of the inert aggregates and to give strength to the concret in its hardened state. The properties of the hardened paste depend upon the characteristics of the cement, the relative proportions of cement and water, and the completeness of chemical combination between cement and water. The chemical process is referred to as hydration. Hydration of the cement requires time, favorable temperatures, and the presence of moisture. This period when concrete is subject to favorable temperature and moisture conditions is known as the *curing period.* Curing periods vary from 3 to 14 days in construction, and in the laboratory a common period is 28 days. Adequate curing is essential for the production of good concrete.

The functions of the aggregate in concrete is to provide a relatively cheap filler for the cementing material; to provide a mass of particles which are suitable for resisting the action of applied loads and abrasion; to provide the perculation of moisture and the action of the weather; and to reduce the volume changes resulting from the setting and hardening process and from moisture changes in the cement water paste. In fresh concrete, the aggregate is, in effect, suspended in the cement paste. Sufficient paste must be present not only to coat the aggregate, but also to fill the voids between them. In hardened concrete, a property such as strength is a function of the density of the paste, which

in turn is controlled by the ratio of water to cement in the original mixture.

It is important to note that in order to produce a workable concrete, far more water is incorporated in a concrete mix than is necessary to hydrate all the cement. That additional water is not necessary for curing if evaporation of the original mixing water from the concrete is prevented. (Spray compounds are usually used in concrete curing.)

Concretes having high water-cement ratios contain more uncombined water than those having low water cement ratios. Therefore, since free water occupies effective pore space, the paste in lean mixtures has a more porous structure than that in rich mixes.

It is well to remember that a mixture of concrete that is too dry or too harsh for given placing conditions and handling equipment will inevitably contain rock pockets. Too wet a mixture gives rise to segregation, honeycomb, and an accumulation of laitance, or sum at the top of each lift.

MIXTURE CONCRETE

The principal requirement in the mixing of concrete is that it be thorough so as to produce uniform consistency; that is, the cement and water content and aggregate grading from beginning to end of each batch must be consistent.

Segregation of concrete occurs because of a heterogeneous combination or a mixture of materials differing in particle size and specific gravity. No consideration should be given to the common erroneous belief that separation occurring in handling will be eliminated in the course of other operations. Separation should be prevented, not corrected. Any lateral movement, which can occur when concrete is deposited at one point and allowed to flow within the forms, or when concrete is projected forward by a conveyor or a swinging bucket, will cause the separation of the coarse aggregate from the mortar.

PREPARATION

Before placing concrete on an earth foundation, the foundation should be moistened to prevent loss of moisture from the concrete. Reinforcing steel should be free of all loose rust or scale by wire brushing, sandblasting, or other effective means. Other non-cohesive coatings likely to be found on parts of the reinforcement are paint, oil, grease, mud, and dried mortar. All such coatings should be removed.

Concrete formwork should be true to grade and alignment, braced against displacement, having a surface finish to produce the desired texture of concrete, be strong enough to resist all vertical and horizontal loads, and have fight points to prevent leakage of mortar during placement of the concrete. Forms should be protected against shrinkage and deterioration prior to concrete placement by proper wetting or oiling. Oiling also prevents sticking of the concrete and facilitates removal of the forms. For wood forms, the oil should be capable of penetrating thereby eliminating sticking and preventing the absorption of water and consequent warping of the forms. Care should also be taken to prevent roughening by the operation of vibrators against the forms.

PLACING CONCRETE

The placing and compacting operations are perhaps the most critical field activities performed by the concrete organization. When concrete must be placed on a slight slope, placing should begin at the lower end of the slope. If placement is begun at the top of the slope, vibration tends to shift the concrete downhill. Rock pockets can be eliminated by shoveling the segregated coarse aggregate onto softer concrete and blending in place by vibration. Shoveling soft concrete over the top of the segregated rock will not correct this type of defect.

In general, drier mixes can be placed better by the use of vibration than by hand tamping. The relation of water-cement ratio to strength holds for vibrated concrete, the same as it does for hand-placed concrete. Vibrators should not be used to transport concrete in the forms, as segregation is likely to result. Vibrators should be inserted to the full depth of each layer and even into the previous layer, provided that layer will become plastic under the vibratory action to ensure good bonding of the layers. Vibratory compaction is completed when mortar begins to flush to the surface adjacent to the vibrator, at the forms, or at the surface of the steel reinforcements. Over vibration of concrete should be avoided, as it causes settling of the coarse aggregate to the bottom and the accumulation of water and mortar at the top.

The natural tendency for water to rise to the surface of freshly placed concrete is known as bleeding. It is the result of the constituent material's inability to hold all the mixing water dispersed throughout the mix. An undesirable effect of bleeding is the accumulation of water films under the particles of the coarse aggregate and under the horizontal reinforcing bars. These voids under the particles make for a

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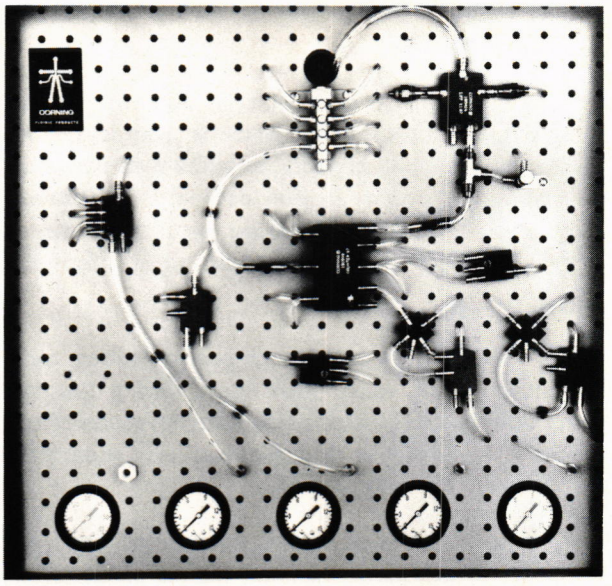
FLUIDICS

GROWING PAINS SLOW PROGRESS

By William P. Chapman



Recent articles predict a great future for fluidic devices. Designers see the devices serving as on-off switches, signal amplifiers, counters, oscillators, proximity sensors and proportioning controllers. According to forecasts, fluidic components soon will replace relays, transistors, potentiometers and other electrical and electronic devices. A $250-million annual market for fluidics is estimated by 1970.

So much for glowing predictions. The fact is that we – the industrial firms in the field – are not progressing as fast as we had planned. As a result, fluidic applications still are few and far between.

This doesn't mean that the basic concept of fluidics is faulty or that the current feeling of fluidics is pessimistic.

On the contrary, the future of fluidics is as bright as ever. We're just going to have to work a little longer to solve problems that are typical when taking a new technology from the laboratory to the production line.

Let's look at the growing pains that have slowed our progress. A key stumbling block is lack of knowledge. Despite all the work that has been done, engineering concepts of fluidics are not that well understood and are not complete.

Industry has been forced to admit this by its inability, up to this point, to develop reliable devices needed to amplify low power input signals to usable output levels. Other factors complicating the job include turbulence, inertia and other characteristics typical of compressible flow.

Research expenses also are slowing fluidics development. Essentially, the industry is paying tuition – in the form of research dollars – for what it hopes will be an expanding market.

Much of the initial work on fluidics was done by or for the military and cost was not a prime consideration. In industrial applications, however, cost is an important factor.

Any discussion of fluidics costs, whether it revolves around development, production or marketing, touches on the fact that fluid amplifiers don't do anything new.

For the most part, the fluid amplifier competes with long-established control devices such as electronic, electric, hydraulic or pneumatic components. Some controls manufacturers, therefore, have been understandably slow to develop or promote a new family of relatively unknown devices to replace their present lines of well understood characteristics.

Before tackling specific problems, I would like to talk for a minute about how the concept of fluidics was developed.

The basic principle was discovered by Henri Coanda – not in his laboratory but in his bathtub. Sitting in his tub one day, Coanda turned on the faucet and noticed the stream of water was running along his arm instead of falling straight down in accordance with Newton's law.

This started Coanda thinking and he remembered a similar experience – one that almost cost him his life. In 1910, Coanda piloted what may have been the world's first jet airplane. He had attached two engine-driven air jets to each wing. A form of afterburner was used to ignite the required additional fuel. Unfortunately, the hot gases streaming from the engines clung to the fuselage. Result: Scratch one airplane and give Mr. Coanda something that he still remembered – rather vividly, I imagine, – 20 years later.

But getting back to the bathtub story. Coanda

reasoned that the entrainment of trapped air caused both phenomena. As the air next to his arm was carried along with the water, it created a partial vacuum. Atmospheric pressure then forced the water stream to cling to his arm. The same principle applied to the hot gases that clung to the fuselage of the ill-fated jet.

Bathtubs and burning airplanes are hardly an auspicious beginning for an industry but in this case they served the purpose.

Nothing much was done with the Coanda principle until after World War II, but recently activity has accelerated.

Today, fluidics is essentially a branch of the controls industry, which embraces electric, electronic and pneumatic components.

Basically, all control devices convert one form of signal to another form. We have devices, for example, that translate temperature to motion and motion to pressure or pressure to motion and back to pressure.

Although we class pneumatic or hydraulic controllers as motion balance, or force balance devices, strictly speaking *all* systems compare the *position* (motion) of the set point with the position of the feedback element. So in that sense all systems may be called motion balance systems.

Let's talk for a moment about a pneumatic controller, because fluidics today is operating essentially with air. The set point position probably is established by manually moving a dial. Its position has the physical unit of length – inches. If we are controlling temperature, the sensor is a bimetal. It moves with change in temperature; hence, its unit is also inches. As it moves, it changes the back pressure of a nozzle; hence, the nozzle converts motion to pressure and the nozzle output is measured in pressure, psi. The nozzle output is also the controller output; hence, feedback device input. The feedback device is a bellows. But a change in pressure in a bellows results in a change in volume; hence, a bellows is a pressure to motion transducer. Its output is measured in inches, and we are back to the comparator which is the bimetal. The comparator has input signals measured in inches; therefore, the output signal must be in inches, and we have a MOTION balance device.

Notice, though, that we had motion converted to pressure and then pressure converted to motion. A fundamental of design is simplicity, so since we want pressure as an output, it follows that we would have a simpler, probably better, design if the comparator worked in psi rather than inches.

This fundamental was recognized in 1959 and when the first fluidic device was developed – one that could operate on pressure alone – fluidics was born. By a coincidence often found in science, the Diamond Ordnance Fuze Laboratory and Johnson Service Company were working in this field independently and unknown to each other. The DOFL approach used flip-flop devices.

Johnson Service, on the other hand, took a different approach. Our objective was to develop a proportional device. Essentially, we were aiming at a high impedance device that could be cascaded in circuits that would be independent of barometric or temperature changes. The result, therefore, would be a component that operates independently of its environment.

For all of our research in fluidics – and we've been involved in the field for over seven years – we sometimes feel we've just begun. One of the reasons is production. In one of our fluidic devices, for example, we must control four basic elements during the production phase. Proportions must be maintained exactly, couplings must be uniform, quality control must be close to absolute, and we must maintain repeatability of assembly, materials and workmanship. We haven't licked the problems completely, but we have made strides, and, in fact, are in limited production now.

What will be the impact of fluidics in the controls market-place?

Most engineers feel that fluidic amplifiers will be used to replace certain electro-magnetic devices such as relays or solenoids, and will move into the field of logic circuit where switching times in the mid multi-second range are acceptable.

Another market is in the area of modulating controls, and there is where Johnson Service Company is concentrating.

It is helpful, I think, to keep our enthusiasm for this new field in perspective. No product ever completely captures a market; it merely takes a part. We're still using a number of Stone Age products, for example, to build our homes – for even though many products have been introduced, stone still is an important material.

But back to fluidics. When the electronics boom hit, people in the pneumatics industry were fearful their days were numbered. Obviously, they were wrong, electronics captured just a part of the pneumatic market. But now fluidics may capture part of the electronics market.

Let's look at the market another way. Why use fluidics instead of electro-pneumatic relays? The first reason is money. It will be costly to train mechanics and technicians to handle the new technology, but the low cost of fluidic components will help industry pay for the training programs. The longer life and higher reliability also adds to the economic advantage of fluidics.

What are the capabilities of fluidic components? Well, for the first time we can design pneumatic systems the same way we design electronic systems. There are fluidic counterparts for resistors, capacitors, transistors, neither-nor circuits and memory banks. And, the lack of moving parts indicates almost infinite operating time.

All of this suggests new design techniques and new technology – from the lab to the shop. At Johnson, we have found that the basic design element must be the black box – not the components that go into the black box. There is a basic reason for this attitude: There aren't enough qualified people in the field that understand the principles of fluidics. In addition, the components have not been described mathematically; hence, the teaching of this new technology is lagging.

From Mr. Coanda's time until today, and most certainly through tomorrow, people will be the single

CONTINUED ON NEXT PAGE

biggest problem in fluidics. Unquestionably, they represent our greatest need.

What type of man is needed most? If I were to advise engineers or engineering students on a career in fluidics, I would suggest they train themselves to be original thinkers, philosophers who can cut through the haze of tradition to the basic problem.

The fluidics man should be a bit of a dreamer, a man interested in solving problems, not designing new gadgets. He should, for example, avoid abortive attempts to follow fads or to force a fluidic circuit down the throat of a problem that really requires an electric system.

On the technical side, I feel the fluidics man should be strong in electrical engineering and also have a solid background in fluid mechanics.

Naturally this poses a problem because these two fields normally are not related. It seems, therefore, that a man should take his B.S. in E.E. and M.S. in fluid mechanics.

I say the E.E. background is essential because control theory is more closely related to electrical circuits. For example, transient response is quite similar to the transient response of a d.c. circuit. Since fluidics is part of the controls industry, it follows then that an E.E. background is advantageous.

Why should fluidics interest an engineer today? Primarily, I think, because it is a new field and because now is the time to get in on the ground floor.

The list of companies interested in fluidic devices is a Who's Who of Industry. They can't all be wrong. Included are General Electric, Brown and Sharpe, Warner and Swasey, Kearney & Trecker, Cincinnati Milling, Eaton Manufacturing, Weyerhauser, Imperial-Eastman, Speidel and General Motors – just to mention those that are thinking fluidics outside the control field.

Process controls also offer a broad field of applications. Moore Products Company uses fluidic devices to proportion air flow in photographic film drying. Bowles Engineering Company is building an integrated fluid logic sequence programmer to control a storage process. Devices developed by Corning control tank levels in the food industry. We, at Johnson, have developed an air conditioning control system.

General Electric uses fluid devices in an automatic system for drawing control instrument air. Philco and Westinghouse are interested in using fluidics to control water and time sequences in home washing machines. The New York Central Railroad controls locomotives with fluid amplifiers and is looking at track switching and other applications.

Applied to the control system of an industrial scrap baler, a small jet of air from a fluid device triggers enough hydraulic force to crush an automobile into a one-foot cube.

In the field of medicine, Harry Diamond Laboratories, previously Diamond Ordnance Fuze Laboratory, has developed fluid amplifiers for controlling heart pumps, respirators, oxygenators and heart massage machines.

It is difficult not to be enthusiastic about fluidics. The applications are ready and waiting for the products to be developed. And, despite current problems, they will be developed.

First, however, we have to climb the mountain of technology foot by foot. The first steps have been harder than we anticipated, but we expect the climb to become a little easier as we broaden our technological base.

Today's problems are many, but they will be solved as all problems are solved – by people. As successful applications of fluidic components increase, more people will be attracted to the field. The more people that get on with the job, the faster the job will be done.

CONTINUED FROM CONCRETE, PAGE 23

structure that is weak because of lack of bond between paste and aggregate.

Bleeding is considered the major cause of present subsidence and setting shrinkage. This is due to the settling of the solids as water bleeds to the top or is withdrawn laterally by the forms. The three methods for determining the amount of entrained air in fresh concrete are the volumetric method, the gravimetric method, and the pressure method. The pressure method is considered the most dependable of the three.

The more rapid the rate of placement, and the less rapid the rate of stiffening, the greater is the maximum pressure developed and the closer the lateral pressure approximates that of a fluid having the same density as the concrete.

CURING CONCRETE

If the concrete surface can be cured properly after removal of the forms, then it is desirable to remove them as soon as possible, as forms made of narrow boards are not fully effective in preventing loss of moisture from the concrete. Furthermore, early form removal permits better repairs if any patching or any other repairs are necessary, as the concrete is then still green and repairs bond to it more readily.

The favorable range in curing temperatures for most concrete appears to be from 60° to 100°F. For mass concrete, fairly low temperatures are usually the most favorable. Temperatures below freezing are decidedly harmful to fresh concrete, as the expansion of the water when transformed into ice causes separation of the solid particles, thus reducing their bond.

PAPER TIGERS NEED NOT APPLY.

Thanks, but they're just not our type. Young engineers who join us are expected to move in on some rather formidable programs . . . with alacrity and lots of gusto. And a willingness to assume early responsibilities on demanding assignments is an attribute which we welcome warmly. It's the kind of engineering aggressiveness that has brought Sikorsky Aircraft to dominant stature in a new world of advanced VTOL aircraft systems.

If our criteria parallel your outlook, you'll find an excellent career environment with us. You would enjoy working (with a select group) on exciting, full-spectrum systems development. And you can watch your talent and imagination assume reality in such diverse forms as Heavy-Lift Skycranes—Tilt Rotor Transports—High-Speed VTOL Commercial Transports—and much more for tomorrow.

Does this responsibility stir your imagination? Then you probably should be with us. There's ample opportunity for innovation in: **aerodynamics • human factors engineering • automatic controls • structures engineering • weight prediction • systems analysis • operations research • reliability/maintainability engineering • autonavigation systems • computer technology • manufacturing engineering • information systems • marketing** . . . and more.

And your career advancement can be materially assisted through our corporation-financed Graduate Study Program—available at many outstanding schools within our area.

Consult your College Placement Office for campus interview dates—or—for further information, write to Mr. Leo J. Shalvoy, Professional and Technical Employment.

Sikorsky Aircraft

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SOCIAL OBLIGATIONS OF THE ENGINEER

By Cristopher A. Kouts

We can start off an article about any period of history whether it be the Roman Era, the Elizabethan Period or the Age of the Hydrogen Bomb with the statement "The world was beset with grave problems." There is no doubt that even in the world of the future some aspiring writers will be toying with the same trite thought if not the same words. It goes without saying that significant social problems were present in every civilization and will continue to be with us in some form through the present and in the future. Yet, I find looking back in retrospect at my earlier engineering and science curriculum, and as I am being strongly and gradually drawn into the cloistered world of science and engineering, that the solutions of social problems are not its primary interest. Instead, I find our social ills have traditionally been and are being left to the politician, the lawyer, the social worker, the labor chief and to any non-technical type that may think of a possible answer or a curative idea. This evidently is expected of the engineer. It appears that his cloistered world reacts only when called upon. For a short while, I saw some semblance of reasoning in the demands of this University for its engineering students to have a firm understanding of the humanities. I thought for a while that there was a great purpose in becoming an engineer, that somehow I would find my place in making some noteworthy contribution for the betterment of this world. You see, idealistic meanderings for a noble purpose or a mighty crusade are still very much a part of me.

It has been said that the technologist possesses the skills of systematically breaking down large and seemly incongruent sets of factors into comprehensible parts that can be worked over effectively. He has the capabilities for developing manufacturing systems, industrial process systems, business information systems, weapons systems and others, yet has done so poorly in providing those systems needed to ease social change. Perhaps they are too difficult to solve completely. Yet, there are some technological efforts I have found which have actually alleviated or simplified social problems. For example, technology has expanded our production capacity so greatly with brilliant advances in energy, mass production, and automation despite inefficient distribution that there is more than enough for everyone. Thus technology has changed the most intractable social problem of widespread poverty into a relatively workable one. Another example is war. Since the development of the hydrogen bomb, it takes more than a simple exchange of insults to start a large scale conflagration.

Solving social problems by motivation of individuals or forcing people in mass to behave more rationally is a most difficult business. Sacrificing immediate gain or pleasure individually for a longer range social gain goes against the grain of the basic nature of man – survival and selfishness. Therefore the moral preachings and educational approaches seem to make small inroads. Here is a case in point which I picked up in a recent article on the water shortage in California. It is a good example of a complicated problem with social and technological overtones. The social worker does not believe it is ethical to steal water from other areas for the benefit of Southern California or to have an affluent farmer use a cloud seeder when others cannot afford one. He suggests that people should be persuaded or ordered to use less water or to stay in the cold north where water is plentiful. The water technologist thinks this is impractical because is goes against the basic nature of man. He sees ways of providing more water more cheaply than the social workers may concede. The arguments pro and con resolved into a technological issue – desalinization. Can fresh water be drawn from the sea cheaply enough to have a major impact on water short areas? Here is a technological fix on a real social problem. Why do we need to preach morality in this case as a sole solution with its expected failures when the engineer can solve this particular problem through concerted application of technical advances?

Another case in point is the Egyptian Spiral Syndrom where more arable land will be brought to bear through the Aswan Dam project to fight the hunger of a growing population which is already outracing the potential production of such land. Do we listen to the social worker or to the dictatorial edicts which surely will eventually foster rationing of food, birth control and possibly economic wars of expansion? Cannot the world of technology foster some answers? Surely the social worker and the technician working together can arrive at some sort of solution. They cannot live in separate worlds but must come together each knowing how to communiciate with the other.

So called social engineers maintain that technological solutions do not get to the heart of the problem. They are right. Immorality according to our standards is always with us with or without technological advances. Such advances often create new problems as old problems are solved. Yet, through technology and engineering, we can provide to the social engineer broader options to make his problems more workable. Our country today faces grave problems. Our government with its great laboratories is technically oriented. Our engineers and scientists are presented with great opportunities and adventures to employ systematic approaches toward resolving social questions which lend to at least partial technological solutions. It is only through dialogue or a crossbreeding of social and technological engineers that our great problems of today will be resolved. The creed of the engineer of today should therefore, as it is for the doctor, include the aim for a better society and thereby a better life for all.

CAMPUS NEWS–CONTINUED FROM PAGE 8

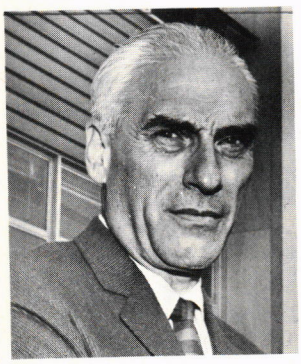
THETA TAU FRATERNITY

Gamma Beta Chapter of Theta Tau, the Engineering Social-Professional Fraternity is pleased to announce its 1968 fall semester pledge class:

1. Mike Rothschild
2. Chuck Schultheis
3. Mark Litchfield
4. Albert Lee
5. Hugh Faust
6. Mark Buchalter
7. Jim Iovino
8. Bob Longson
9. David Forsyth
10. Steve Momii
11. Marshal Azrael
12. Howard Kellman

Marshal Azrael is president of the Pledge class; Jim Iovino is sports director; and Greg Eichert is Pledge master.

GEORGE ELLOWITZ BECOMES EXECUTIVE ASSISTANT



George Ellowitz

This past summer George Ellowitz became the Executive Assistant to the Dean of The School of Engineering and Applied Science. Mr. Ellowitz did his undergraduate work at The George Washington University, obtaining his BA in Journalism in 1951. He has more than 25 years of experience as a technical writer, editor, and publications coordinator. He has worked for government (Department of Defense, National Bureau of Standards, Department of the Navy) and Industry (Motorola Systems Research and Development Laboratory, Riverside, Calif.; North American Rockwell, Anaheim, Calif.). He has written, edited, and coordinated for publication technical manuals and field manuals, for the operation of all types of ordnance equipment, and proposals in almost every known scientific and engineering discipline.

Before coming to the University in June 1968, Mr. Ellowitz was employed by Leasco Inc., as Senior Technical Writer and Supervisor in Charge of the NASA Tech Brief Program at the NASA Scientific and Technical Information Facility.

COMPUTER EXPERT JOINS SEAS

Dr. G. Hintze

Computer expert Guenther Hintze has been appointed to a professorship at the George Washington University School of Engineering and Applied Science. In making the announcement, Dr. Harold Liebowitz, Dean, said Hintze will teach advanced and graduate courses and work with the university's research staff for systems analysis.

For almost 23 years prior to joining GWU, Hintze was director of Analysis and Computation Directorate, National Range Operations, at White Sands Missile Range. While at WSMR, he was instrumental in the establishment of their Flight Simulation Laboratory in 1958. In this lab missiles were "fired on paper" for a fraction of the cost of a real missile. Through paper-testing pertinent information relative to missile design, behavior and capabilities could be gained.

Since 1958, in addition to missile work, he has taught a computer and systems analysis course at the University of Texas at El Paso. In 1966 Hintze wrote *Fundamentals for Digital Machine Computing,* a basic text for training computer users.

Hintze believes that the university has a valuable service to offer government and industrial agencies that have a need for modern systems analysis of highly complex systems. He said he hopes that his experience in this field will be instrumental in attracting computer research work to GW.

Hintze was awarded an honorary doctor's degree by New Mexico State University in 1962. This was for his encouragement of a graduate study program between the university and WSMR and for his original contribution to the non-destructive testing of large systems.

Born and reared in Breslau, Germany, Hintze received his masters in electrical engineering in 1929 from Technological College there. He came to the United States in 1945.

Hintze and his wife Elsie lives in Georgetown. They have three grown children.

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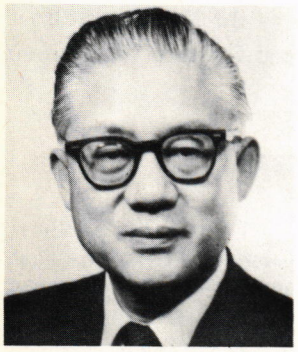
DR. YUAN JOINS SEAS



Dr. S. W. Yuan

Dr. Harold Liebowitz, dean of the George Washington University School of Engineering and Applied Science, has announced the appointment of S. W. Yuan to a professorship in the school's engineering mechanics department.

Yuan came to George Washington from the University of Texas where he was a professor of aerospace engineering for the last ten years. In 1957 he was appointed to the chair of Canadair Professor of Fluid Mechanics at the Universite Laval in Quebec. Prior to that he was professor of aeronautical engineering at the Polytechnic Institute of Brooklyn from 1945 to 1956.

Yuan holds a B.S. degree from the University of Michigan, an A.E. degree from Stanford University, and an M.S. and Ph.D. from the California Institute of Technology, all in aeronautical engineering.

In 1967 he published *Foundations of Fluid Mechanics* a basic text for introductory or secondary courses. It has been well received in the United States, Europe and Asia and a second printing is in preparation.

From 1941 through 1945, Yuan worked in private industry with the Vidol Research Corporation, the Glenn Martin Company and McDonnell Aircraft Corporation. During this time, he developed the Martin-Yuan Y-3 Low Drag Airfoil which was used in various Martin airplanes including the Martin 202 and 404 commercial airplanes. He was in charge of the research group which conducted the work on the McDonnell XHJD-1 Helicopter.

Yuan was on leave of absence from Brooklyn Polytechnic during 1950 and 1951 to work with Dr. Theodore von Karman on Circulation Control Research at the Aerojet Corporation, Azusa, California. This later led to several joint patents with Dr. von Karman on Jet Circulation Control VTOL rotor system.

The Jet Circulation Control rotor system is considered a technical breakthrough in rotary wing design for extra-large or high speed VTOL aircrafts.

While at Brooklyn Polytechnic, Yuan pioneered the research work on mass transfer cooling. As a result of this research, he was invited to be a contributing author for the Princeton Series on High Speed Aerodynamics and Jet Propulsion.

He has served as consultant to various industrial and governmental research laboratories including Oak Ridge National Laboratory, North American Aviation, Inc., Cornell Aeronautical Laboratory, and the National Center of Research of China in Taiwan.

ASCE

The American Society of Civil Engineers has scheduled the following films to be shown at their meetings this fall:

Oct. 23 – "Men, Steel and Earthquakes"

Oct. 30 – "The Invisible E"

Nov. 6 – "Fury of the Winds"; "This is Steel"

Dec. 11 – "Skylines"; "The Invisible Power of Coal"; "Building the Golden Gate Bridge"

Jan. 8 – "Deep Frontier"; "Open Road"

All students are invited to attend, and civil engineering students are encouraged to become members.

ECPD RESULTS

As you know, the Engineer's Council for Professional Development (ECPD) is the accrediting agency for engineering curricula. They visit periodically Schools of Engineering to examine in great detail the existing curricula and, based on such examinations, accredit or not accredit a given curriculum.

In April 1968 an ECPD team to examine our curricula and School. All three curricula of Civil, Electrical and Mechanical Engineering were given a four-year accreditation.

In particular, the following are the comments of ECPD on the Electrical Engineering curriculum:

Electrical Engineering

The curriculum is modern. There is a good balance in the basic sciences, mathematics, engineering sciences, humanities and social sciences, and engineering design and analysis. Plans are underway to alleviate rigidly in the program by the addition of appropriate technical electives. The faculty is very good. Six of the nine members have doctorates; another is completing requirements for that degree. Experience backgrounds range from academic through industrial and research. Morale is high, with expectations of significant accomplishments in the future.

The undergraduate electronics and communications laboratories are well equipped and well organized. The addition of the control systems and energy conversion laboratory will add to the laboratory complex in a favorable way. Particularly impressive is the research program in medical engineering and the involvement of undergraduate students in that activity.

—Dr. de Pian

CONTINUED FROM PAGE 20

The new Computer Science curriculum will prepare students for the high-paying jobs available in this field.

puter science not only teaches how to use particular computer languages but also the theory underlying these languages and how to design new languages. It also teaches the theory and design of computer operating systems and the theory and design of computer structures.

This new Computer Science Curriculum is not the first time that such a curriculum has been taught in SEAS. As early as 1956-57, an undergraduate curriculum called Machine Computers was developed by Dr. Robert Ledley, a noted authority on computers. This curriculum, shown below, led to a BSE degree and was rather primitive by today's standards, but it still had many topics in common with a contemporary curriculum.

1956-57 Machine Computer Option

Junior Year	
ME 111-12 Thermodynamics	6
CE 123 Strength of Materials	3
CE 132 Fluid Mechanics	4
EE 107 Alternating-Current Circuits	3
Phys 132 Electronics	3
Stat 157-58 Mathematical Statistics	3
Math 112 Math for Engineers & Scientists	3
Math 265 Modern Algebra	3
Elective	6
	34
Senior Year	
ME 141-42 Management Problems	4
Phys 133 Electronic Circuits	3
EE 110 Communications Engr	3
EE 123 Communication Lab I	2
EE 137 Applied Electronics	3
EE 171 Modern Computing Machines	3
EE 172 Machine Computer Circuitry	3
Math 126 Advanced Analytic Geometry	3
Math 243-44 Numerical Analysis	6
Elective	3
	33

The 1956-57 curriculum was not balanced in level because it required undergraduates to take too many graduate level courses. The author knew the curriculum very well since he graduated from it in 1958. A version of a Machine Computers Option was offered from 1956 through 1966. It was discontinued from the academic years 1967-68 and 1968-69 but will be offered once again with a newer and more comprehensive curriculum starting in the fall semester of 1969.

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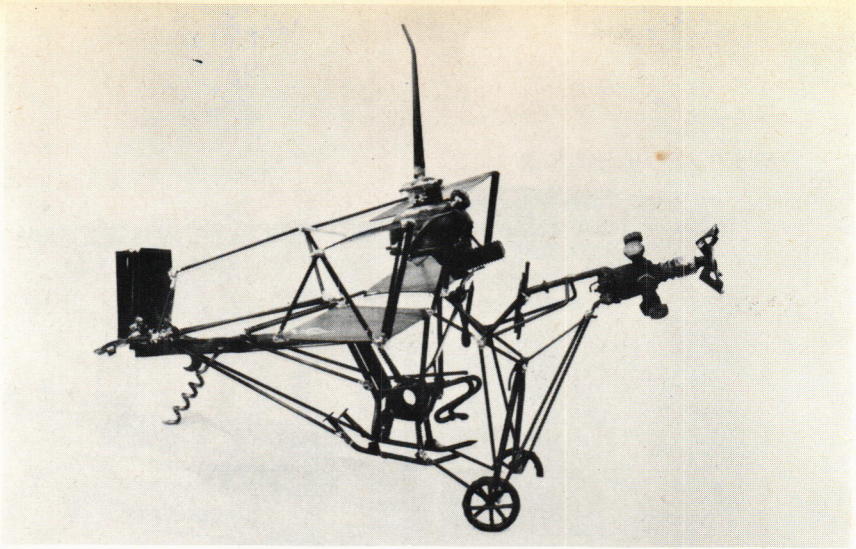
1. Report of the ACM Curriculum Committee on Computer Science, Communication of the ACM, Volume 11, Number 3, March 1968.

2. Interim Report of the Cosine Committee of the Commission on Engineering Education, September 1967.

3. Bulletin of the School of Engineering and Applied Science, The George Washington University, 1956-57.

4. Bulletin of the School of Engineering and Applied Science, The George Washington University, 1969-70. (In press)

Tale Spin



The boy of ten, walked into a bar, and sat down at a table. A young barmaid walked over and asked the boy what he wanted. "Give me a shot of whisky!" he ordered.

"Do you want to get me in trouble?" She asked.

"Maybe later, right now all I want is a shot of whisky."

* * *

A true music lover has been defined as a man who puts his ear to the keyhole when he hears a girl singing in the tub.

* * *

English instructor to E.E.: "Do you enjoy Browning?"

E.E.: "No, but I sometimes have to resort to it around exam time."

* * *

Co-ed: "Where did you learn to kiss like that?"

C.E.: "Siphoning gas."

* * *

E.E.: "My brother is working with 5,000 men under him."

M.E.: "Where?"

E.E.: "Mowing lawns in a cemetery."

* * *

"I just got a bottle of Scotch for my wife."

"Well that sounds like a fair swap."

* * *

Hear about the new deodorant called Vanish? It makes you disappear and everybody wonders where the odor is coming from.

The brush salesman was talking: "I'll never forget the time this woman opened the door in her negligee – which was kind of an odd place to have a door."

* * *

E.E. to blind date: "I never believed in reincarnation, but what were you before you died?"

* * *

Bad trip: acid indigestion.

* * *

"Wait till you hear!" said one coed to another. "I went to the movies last night and I had to change my seat three times!"

"You mean you were actually molested?"

"Eventually."

* * *

Coed: "Don't you dare kiss me again. Why I hardly know you."

E.E.: "I won't. I'm just trying to find out who has the gin at this party."

* * *

Guest: "Why does your dog keep staring at me like that?"

Host: "I guess it's because you've got the plate he eats from."

* * *

"But Darling, this isn't our baby."

"Shut up, it's a better buggy."

* * *

Coed: "Did you hear the horrid things they have been saying about me?"

E.E.: "Why do you think I came over?"

* * *

Why do Policemen have bigger Balls than Firemen do? They give out more tickets.

* * *

What do Eskimos get from rubbing noses?

Sniff-less.

Join a firm that'll give you executive responsibility your first day at work.

Now, that's a pretty funny thing for a civilian firm to say. A boss? Right out of college? The first day?

But the Air Force can make such offers.

As an officer in the world's largest technological organization you're a leader. Engineer. Scientist. Administrator. Right where the Space Age breakthroughs are happening.

Or how about the executive responsibility of a test pilot clocking 2,062 mph in a YF-12A jet?

That could be you, too.

But you don't have to be a pilot in the Air Force to move fast. With your college degree you zip into Officer Training School, spin out an officer, speed on your way as an executive, in the forefront of modern science and technology. Right on the ground.

The Air Force moves pretty fast.

Think it over. A man's career can sometimes move pretty slow.

United States Air Force

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COLLEGE _____ GRADUATE DATE _____

MAJOR SUBJECT _____

CAREER INTERESTS _____

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Washington, D. C.

Dan Johnson has a flair for making things.

Just ask a certain family in Marrakeck, Morocco.

A solar cooker he helped develop is now making life a little easier for them—in an area where electricity is practically unheard of.

The project was part of Dan's work with VITA (Volunteers for International Technical Assistance) which he helped found.

Dan's ideas have not always been so practical. Like the candlepowered boat he built at age 10.

But when Dan graduated as an electrical engineer from Cornell in 1955, it wasn't the future of candlepowered boats that brought him to General Electric. It was the variety of opportunity. He saw opportunities in more than 130 "small businesses" that make up General Electric. Together they make more than 200,000 different products.

At GE, Dan is working on the design for a remote control system for gas turbine powerplants. Some day it may enable his Moroccan friends to scrap their solar cooker.

Like Dan Johnson, you'll find opportunities at General Electric in R&D, design, production and technical marketing that match your qualifications and interests. Talk to our man when he visits your campus. Or write for career information to: General Electric Company, Room 801Z, 570 Lexington Avenue, New York, N. Y. 10022

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